

TAXONOMIC NOTES ON *CISTANTHE*, *CALANDRINIA*, AND
TALINUM (PORTULACACEAE)

Mark A. HersHKovitz

Department of Botany, University of California, Davis, California 95616
U.S.A

ABSTRACT

New combinations for South American species of *Cistanthe* are provided along with taxonomic notes. Also, a new section of *Calandrinia* and a new combination in *Talinum* are established. The nomenclatural changes reflect new morphological and cladistic data on Portulacaceae.

KEY WORDS: Argentina, *Calandrinia*, Chile, *Cistanthe*, *Monocosmia*, Perú, Portulacaceae, *Talinum*, taxonomy

In a previous paper (HersHKovitz 1990a), I established a sectional taxonomy and several combinations for *Cistanthe* Spach (Portulacaceae). These proposed changes reflected corroboration by leaf morphological evidence (HersHKovitz 1990b) of Carolin's (1987) cladistic analysis of Portulacaceae, in which he concluded that *Cistanthe* should be segregated from *Calandrinia* Kunth in H.B.K. I also proposed (HersHKovitz 1990b) that *Monocosmia* Fenzl in Endl. & Fenzl is phylogenetically nested in *Calandrinia* and should be included therein. I provide below: (1) additional combinations for South American species of *Cistanthe*, along with miscellaneous notes and lists of material examined; (2) a sectional status for *Monocosmia* in *Calandrinia*; and (3) a new combination in *Talinum* Adans. for a species currently classified in *Calandrinia*.

1. *Cistanthe* NEW COMBINATIONS AND NOTES

In my studies of leaf morphology in Portulacaceae (HersHKovitz 1990b), I noted that specimen identification and species delimitations of South American *Cistanthe*, heretofore classified in *Calandrinia* (cf. HersHKovitz 1990a, 1990b) and *Philippiamra* Kuntze (= *Silvaea* Philippi), were not adequately facilitated

by existing floristic treatments. At the same time, I concurred with Carolin (1987, in press) that Portulacaceae taxonomy was poorly served by the retention of these species under their existing generic assignments. The first problem I circumvented by sampling leaves representative of the range of gross morphological variation in *Cistanthe* as evident from herbarium specimens. The second problem is more difficult to resolve because there is simply no means short of a detailed monographic study to determine which of at least 60 combinations of *Calandrinia* and *Philippiamra*/*Silvaea* referable to *Cistanthe* will prove to correspond to distinct species.

An example of the sort of taxonomic problems I encountered can be demonstrated by comparing accounts by Reiche (1898) and Johnston (1929) of the *Cistanthe grandiflora* (Lindley) Carolin ex Hershkovitz complex. According to Reiche (1898), *Cistanthe grandiflora* represents a single polymorphic species with a total of eleven synonyms variously referable to three more or less distinct varieties corresponding to *Calandrinia grandiflora* Lindley, *Calandrinia discolor* Schrad., and *Calandrinia speciosa* Lehm. Johnston (1929, pp. 36, 37, 147), however, made several remarks indicating that he recognized at least some of the variants as distinct species. In addition, Johnston (1929) characterized two new species as members of the *Cistanthe grandiflora* complex. The difference in opinion cannot be attributed merely to a tendency by Johnston to split taxa. For example, Reiche (1898) recognized four species in *Cistanthe* sect. *Philippiamra*, while Johnston (1929, p. 39) wrote that "further studies will show [three of] these species ... to be phases of one variable species ..."

In the present paper, I provide new combinations for South American species of *Cistanthe* examined in my leaf morphological studies, along with remarks on possible synonyms and lists of examined specimens. This paper brings the total number of recombined names for South American species to 17 – twelve for *Cistanthe* sect. *Cistanthe*, three for *C.* sect. *Amarantoides*, and two for *C.* sect. *Philippiamra* (cf. also Hershkovitz 1990a). These figures will increase eventually – I suspect additional research may well establish that the actual numbers in each section are roughly twice these numbers. Unless otherwise noted, the species recombined here are presumed to include the synonyms listed elsewhere, and no judgment is implicit in my failure to mention other pertinent species of *Calandrinia* elsewhere recognized. There has never been a comprehensive key to the South American species of *Cistanthe*. The most extensive key, provided by Reiche (1898) for the Chilean species, emphasizes variable vegetative and sometimes nebulous traits (cf. Carolin 1987). Given the preliminary nature of the present work, however, I am unable to offer a useful alternative. Identifications, unfortunately, will continue to require the use of the keys in the cited floristic literature and simple description/specimen comparisons.

For the present work, I consulted type descriptions and regional floristic literature provided by Reiche (1898) and Philippi (1860a, 1860b, 1894a, 1894b)

for Chile; Johnston (1928, 1929) for northern Chile and Perú; Macbride (1931, 1937) for Perú; Cullen (1953) for Argentina; and Peralta (1988) for the Argentinian province of Mendoza. I also considered descriptions of seed and trichome morphology provided by Kelley (1973) for *Cistanthe* sections *Cistanthe* and *Amarantoides*, and my own observations of herbarium material and anatomical preparations thereof (Hershkovitz 1990b). I have seen photographs of supposed type material of many of the species (see below), but I generally cannot confirm their authenticity.

A few years ago, Roger Carolin (SYD) provided me with an unpublished manuscript that included several of the combinations listed below and several others. Carolin proposed several combinations in *Cistanthe* that represent, I believe, synonyms of other species. In any case, I employ the "ex" notation to indicate Carolin's authorship of the names contained in his manuscript.

A. *Cistanthe* sect. *Cistanthe*

Cistanthe sect. *Cistanthe* comprises all species of *Calandrinia* sect. *Cistanthe* (Reiche), *Calandrinia* sect. *Rosulatae* Reiche, *Calandrinia* sect. *Arenariae* Reiche, and *Calandrinia* sect. *Andinae* Reiche (cf. Hershkovitz 1990b; Kelley 1973; Reiche 1897, 1898).

Cistanthe arenaria (Diels) Carolin ex Hershkovitz, *comb. nov.* BASIONYM:
Calandrinia arenaria Cham., *Linnaea* 6: 563. 1831.

SPECIMENS EXAMINED: CHILE. Aconcagua: *Bertero 1348* (photograph of type of *Calandrinia chamissoi* Barnéoud in Gay, US ex G-DEL); *Morrison 16917* (CAS, NA). Atacama: *Philippi s.n.* (photograph of type of *Calandrinia polyclados* Philippi, US ex G-DEL). Coquimbo: *Joseph 4507* (US); *Joseph 4511* (US); *Simon 441* (UC); *Simon 454* (UC); *Wagenknecht 18444* (F - two sheets, UC); *Worth & Morrison 16955* (CAS, NA); *Zollner 6098* (L). Metropolitana: *Joseph 2788* (US). Ñuble: *Joseph 9990* (US).

Cistanthe arenaria is an annual with numerous branches spreading from the base and rhombic to linear leaves. The species is apparently closely related to *Cistanthe fenzlii* (Barnéoud in Gay) Carolin ex Hershkovitz, which is perennial and has more erect branches (cf. Reiche, 1898). *Calandrinia solisii* Philippi appears to be somewhat intermediate between *Cistanthe arenaria* and *Cistanthe fenzlii*, so for now, I refer all intermediate plants to one species or the other.

Cistanthe arenaria is widely distributed and highly variable (cf. Reiche, 1898). Some of the cited specimens (e.g., *Wagenknecht 18444*) correspond perfectly to Reiche's (1898) key and description. The largest plants, however,

appear similar to supposed type material of *Calandrinia polyclados* Philippi, which Reiche regarded as a synonym of *Cistanthe fenzlii*.

Joseph 4507 and *4511* key to and had been determined as *Calandrinia glaucopurpurea* Reiche. Reiche's (1898) description of *Calandrinia glaucopurpurea*, however, also corresponds to that of *Calandrinia chamissoi* Barnéoud in Gay, which Reiche (1898) recognized as a variety of *Cistanthe arenaria*. Reiche (1898) recognized two other varieties of *Cistanthe arenaria*, but I cannot determine whether these are discrete.

Joseph 3990 more or less keys to and was determined as *Calandrinia solisii*, but the specimen has a slender, rather than thick (perennial?; cf. Reiche 1897) root. I am not convinced that the key trait (sterile inflorescence bracts present vs. absent; Reiche 1898) and the difference in root morphology that distinguish *Calandrinia solisii* from *Cistanthe arenaria* collectively warrant specific recognition of the former.

I have elsewhere (Hershkovitz 1990b) cited *Neger s.n.* (M) and *Zollner 10636* (NA) as *Cistanthe arenaria*. The former specimen I believe is *Cistanthe fenzlii*, although it also conceivably keys to *Calandrinia solisii*. The latter is a mixed collection with some *arenaria*-like plants (see indets. listed below). I also cited *Zollner 9807* incorrectly as *Cistanthe glaucopurpurea* (see indets. listed below).

Cistanthe cephalophora (I.M. Johnston) Carolin ex Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia cephalophora* I.M. Johnston, *Contr. Gray Herb.* 85:35. 1929.

SPECIMENS EXAMINED: CHILE. Antofagasta: *Pennell 13032* (US); *Werdermann 855* (CAS, UC, US).

This distinctive species has a capitate inflorescence and hairy seeds, but otherwise resembles *Cistanthe longiscapa* (Barnéoud in Gay) Carolin ex Hershkovitz.

Cistanthe coquimbensis (Barnéoud in Gay) Carolin ex Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia coquimbensis* Barnéoud in Gay, *Fl. Chile [Hist. Física y Política de Chile, Botánica]* 2: 483. 1847 ("1846").

SPECIMENS EXAMINED: CHILE. Locality not determined: *Gay s.n.* (photograph of type, US ex P); *Joseph 4973* (US). Coquimbo: *Werdermann 881* (CAS, F, UC).

This species seems to be related to the *Cistanthe longiscapa* alliance (*Calandrinia* sect. *Rosulatae* Reiche, cf. Reiche 1898; see also below). The cited specimens, both previously identified as *C. coquimbensis*, key to this species more or less by default rather than by critical traits – the other species in this section (Reiche's nos. 22-26) are quite distinct from *Cistanthe coquimbensis*. The cited specimens differ from *Cistanthe longiscapa* in: (1) having more

spreading or prostrate, rather than erect, flowering branches; (2) having longer, relatively narrower, and more distinctly petiolate leaves; and (3) having more foliage leaves scattered along the flowering branches rather than just near the base. In these respects, the specimens approach members of *Calandrinia* sect. *Arenariae* Reiche. The leaf venation pattern also appears distinct from that of *Cistanthe longiscapa* (cf. Herskovitz 1990b). The examined material has ca. 15 stamens, rather than 6-8 as reported by Reiche (1898).

Cistanthe cymosa (Philippi) Herskovitz, *comb. nov.* BASIONYM: *Calandrinia cymosa* Philippi, Ann. Univ. Chile 85:192. 1893.

SPECIMENS EXAMINED: CHILE. Antofagasta: *von Bayern s.n.*, "11.x. 1898" (M); *Werdermann 859* (B, CAS, M, UC, US); *Worth & Morrison 15816* (NA, UC). Atacama: *Johnston 4787* (US).

This species is related to the *Cistanthe longiscapa* alliance (cf. Reiche, 1898). Its distinctive feature is its nearly corymbiform inflorescence with numerous congested flowers. The flowers are yellow and the seeds black and shiny. The sepals in the cited specimens appear waxy to glutinous, a feature noted for *Calandrinia chrysantha* I.M. Johnston, which Johnston (1929) regarded as most closely related to *Cistanthe cymosa* – they may prove to be the same species.

Cistanthe fenzlii (Barnéoud in Gay) Carolin *ex* Herskovitz, *comb. nov.* BASIONYM: *Calandrinia fenzlii* Barnéoud in Gay, *Fl. Chile* [*Hist. Física y Política de Chile, Botanica*] 2:493. 1847 ("1846").

SPECIMENS EXAMINED: CHILE. Locality not determined: *Gay s.n.* (photograph of type, US *ex* P). Bio-Bío: *Joseph 4015* (US); *Neger s.n.*, "Nov 1896" (two sheets, probably duplicates, M); *Philippi s.n.* (US).

In Reiche's (1898) key, *Cistanthe fenzlii* is set off from *Cistanthe arenaria* only by virtue of the more erect stems in the former. The description, however, also notes that *Cistanthe fenzlii* has a thick root, and, indeed, the cited specimens appear to be perennials. Judging from a Philippi-determined specimen (*Philippi s.n.*), Reiche (1898) was correct in regarding *Calandrinia sanguinea* Philippi as a synonym of *Cistanthe fenzlii*.

Reiche (1898) also listed *Calandrinia polyclados* Philippi in synonymy with *Cistanthe fenzlii*, but the photograph of the type of the former (see *Cistanthe arenaria* above) is more highly branched, has broader leaves, and has less congested inflorescences than the photograph of the type of the latter and the specimens cited here.

Cistanthe grandiflora (Lindley) Carolin *ex* Herskovitz, *Phytologia* 68:269. 1990.

SPECIMENS EXAMINED: Cultivated: *Peele* 154 (NA). Without data: one sheet (B); one sheet, no. 906253...39 (L). Without collector and locality: 993 (L). CHILE. Without locality: *Bernhardi* 33 (B). Aconcagua: *Behn* s.n. (UC); *Blood & Tremelling* 427 (NA); *Buchtien* s.n. (US); *Eyerdam & Beetle* 24642 (UC); *Hutchinson* 176 (UC); *Joseph* 1764 (US); *Morrison* 16872 (NA, UC); *Rose & Rose* 19138 (US); *Simon* 446 (UC); *Stebbins* 8547 (UC); *Stebbins* 8592 (UC); *Werdermann* 39 (UC); *West* 3959 (F, UC - two sheets, US - two sheets); *West* 4574 (UC); *Zollner* 8364 (NA). Antofagasta: *Worth & Morrison* 16133 (NA, UC). Atacama: *Beetle* 26143 (UC); *Harding* 22847 (US); *Werdermann* 405 (F, US); *West* 3868 (UC); *Zollner* 4079 (L). Bio-Bio: *Hutchinson* 234 (UC, US). Coquimbo: *Simon* 447 (UC); *Simon* 462 (UC); *Simon* 465 (UC); *Wagenknecht* 18562 (UC); *Zollner* 6327 (L); *Zollner* 10284 (NA). Metropolitana: *Hastings* 268 (UC); *Morrison* 16816 (UC); *Philippi* s.n. (US). O'Higgins: *Aravena* 33343 (UC).

I alluded above to the taxonomic problems in the *Cistanthe grandiflora* complex. I am unable to sort these specimens into finer, discrete specific entities. The Antofagasta and Atacama specimens, however, seem coarser and more succulent than the rest. Three of these (*Beetle* 26143, *West* 3868, *Worth & Morrison* 16133) were annotated as *Calandrinia taltalensis* I.M. Johnston *vide* Johnston. I have elsewhere (Hershkovitz 1990b) cited *West* 3959 as *Cistanthe glauca* (Schrad.) *ined.*, and *Worth & Morrison* 16133 as *Cistanthe taltalensis* (I.M. Johnston) *ined.*, but I chose not to recognize these combinations at present.

Cistanthe lingulata (Ruíz Lopez & Pavón) Hershkovitz, *comb. nov.* BASIONYM: *Talinum lingulatum* Ruíz Lopez & Pavón, *Syst. Veg. Fl. Peruv. Chil.* 115. 1798.

SPECIMENS EXAMINED: PERÚ. Ancash: *Ferreyra* 13532 (US). La Libertad: *López Miranda* 374 (US). Lima: *Dombey* (number illegible, possibly 170; P); *Dombey* (number illegible, possibly 716; P); *Ferreyra* 10486 (US); *Ruíz Lopez & Pavón* s.n. (photograph of type, US ex G-DEL); *Weberbauer* 7432 (US).

According to Macbride (1937), *Cistanthe lingulata* differs from *Calandrinia quivensis* Macbride only in having a less exserted capsule. He noted, however, that capsule exsertion may reflect capsule maturity, so that the two species might be the same. Therefore, I have included all material keying to either species in *Cistanthe lingulata*. Of the cited specimens, the most extreme exsertion of the capsule occurs in both of the Ferreyra specimens.

Cistanthe lingulata also apparently intergrades with *Cistanthe weberbaueri* (Diels) Carolin *ex* Hershkovitz. According to Macbride (1937), *Cistanthe weberbaueri* differs from *C. lingulata* in having an "umbellate-fasciculate" rather than "racemose or paniculate" inflorescence. Such a difference typifies younger

and more mature inflorescences, respectively, in *Cistanthe*. My determinations emphasize apparent distinctions in leaf morphology: The leaves of specimens referable to *Cistanthe lingulata* are generally narrower (<10 mm) than those of *Cistanthe weberbaueri* (>10 mm), and, while their venation patterns are similar, the vein orders of *Cistanthe weberbaueri* are more distinct and the vein reticulum appears denser even in comparably sized leaves (cf. Hershkovitz 1990b). *Weberbauer 7432*, however, was cited as *Calandrinia weberbaueri* by Macbride (1937) but has linear-filiform leaves less than 5 mm wide. The inflorescence is immature in this specimen, so I cannot evaluate the other key characters.

Cistanthe longiscapa (Barnéoud in Gay) Carolin ex Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia longiscapa* Barnéoud in Gay, *Fl. Chile* [*Hist. Física y Política de Chile, Botánica*] 2:492. 1847 ("1846").

SPECIMENS EXAMINED: CHILE. Without locality: *Gay s.n.* (photograph of type of *Calandrinia longifolia* [sic], US ex P). Antofagasta: *Werdermann 1046* (leg. Francke; UC, US). Atacama: *Johnston 5034* (US); *Morong 1267* (NA, US); *Philippi s.n.* (US); *Werdermann 445* (F, UC); *Worth & Morrison 16164* (NA, UC); *Worth & Morrison 16267* (NA, UC); *Zollner 4083* (L); *Zollner 9291* (NA); *Zollner 11917* (NA).

Cistanthe longiscapa is distinguished from *C. cephalophora* and *C. cymosa* by its more open inflorescence. Vegetatively, these three species are similar in having relatively broad and tending towards orbicular leaves crowded near the base of the plant and typically a pair of subopposite leaves at the base of the inflorescence.

I tentatively refer *Calandrinia litoralis* Philippi to *Cistanthe longiscapa*. From the examined material, I cannot identify the putative differences between these species in bract morphology (cf. Reiche 1898). Pubescent seeds supposedly characterize *Cistanthe longiscapa*, while glabrous seeds characterize *Calandrinia litoralis* (Kelley 1973; Reiche 1898). The specimens cited above have variously pustulate-tomentose or glabrous seeds, but are otherwise very similar. According to Reiche (1898), *Cistanthe longiscapa* flowers in September-October, while *Calandrinia litoralis* flowers in December-January. Most of the cited specimens have September-October collection dates, while *Johnston 5034* lists November 25, and *Zollner 4083* lists January 12. The last two specimens are clearly in more mature stages than the September-October collections.

The Atacama collections are mostly from the vicinity of Copiapó. The Antofagasta collection (*Werdermann 1046*) is unusual and may be misdetermined. This specimen includes a fragment of an inflorescence and a whole plant that appears to have been prostrate with a flowering scape barely 5 cm long. The bracts and sepals are not conspicuously etched with black markings. The absence of these etchings is unusual in *Cistanthe* sect. *Cistanthe*.

Cistanthe macrocalyx (Hauman) Carolin ex Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia macrocalyx* Hauman, Ann. Soc. Cient. Argentina 86:253. 1919.

SPECIMEN EXAMINED: ARGENTINA. San Juan: *Castellanos 15587* (US).

Cullen (1953) and Peralta (1988) recognized this species as distinct from *Cistanthe picta* (Gillies ex Arn. in Cheek) Carolin ex Hershkovitz in their treatments for Argentina and Mendoza, respectively. It is distinguished from the latter by its smaller, oblanceolate leaves and larger, relatively broader calyx. The specimen cited above agrees with the description in leaf morphology, but the flowers have largely been lost.

Cistanthe paniculata (Ruíz Lopez & Pavón) Carolin ex Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia paniculata* Ruíz Lopez & Pavón, *Syst. Veg. Fl. Peruv. Chil.* 114. 1798.

SPECIMENS EXAMINED: PERÚ. Ancash: *Dillon, et al. 4627* (F); *Dillon, et al. 4633* (F); *Dillon & Santistebau 4706* (F); *Ferreyra 6350* (US); *Ferreyra 11576* (US); *Ferreyra 12022* (US); *Ferreyra 12611* (US); *Hutchinson 1292* (US, UC); *Stork, et al. 9169* (UC); *Weberbauer 1484* (B). Arequipa: *Dillon, et al. 3265* (F); *Dillon, et al. 3292* (F); *Dillon & Dillon 3843* (F); *Worth & Morrison 15761* (NA, UC). La Libertad: *Dillon, et al. 2718* (F); *Dillon, et al. 4656* (F); *Dillon, et al. 4693* (F). Lima: *Soukup 2156* (US); *Stork & Vargas 9363* (UC). Tacna: *Dillon, et al. 3384* (F); *Dillon & Dillon 3662* (F); *Ferreyra 12502* (US); *Ferreyra 12507* (US); *Ferreyra 12519* (US).

I tentatively regard *Cistanthe paniculata* and *Calandrinia ruizii* Macbride as belonging to a single polymorphic species based on hints to this effect in the literature and my inability to readily sort the specimens. According to Macbride's (1937) key and description, *Cistanthe paniculata* differs from *Calandrinia ruizii* in having a more exserted capsule, more densely pubescent seeds, and "obovate-oblong" rather than "broadly obovate or subrotund" leaves with acuminate rather than "merely apiculate" apices. Macbride (1937) listed *Calandrinia adenosperma* I.M. Johnston as a synonym of *Cistanthe paniculata*, but he had previously noted (Macbride 1931) that *Calandrinia ruizii* was also similar to *Calandrinia adenosperma*. Johnston's (1928) description of *Calandrinia adenosperma* essentially bridges the gap between the descriptions of *Cistanthe paniculata* and *Calandrinia ruizii*: As in *Calandrinia ruizii*, the sepal and capsule lengths in *Calandrinia adenosperma* are equal, and the upper leaves are subamplexicaul and orbicular-ovate with obtuse apices.

Cistanthe paniculata, *Calandrinia ruizii*, and *Calandrinia adenosperma* all reportedly have hairy seeds (Johnston 1928; Kelley 1973; Macbride 1937), but I have found glabrous seeds, apparently not correlated with any other trait in

several of the specimens. Label data from the cited collections also indicate that flower color (yellow vs. red) also varies independently of other traits (cf. Macbride 1937).

Macbride (1931, 1937) and Johnston (1928) both believed *Cistanthe paniculata* to be especially closely related to *Cistanthe grandiflora*. Preliminary studies (Hershkovitz 1990b) indicate that the latter, also a polymorphic species complex, is distinctive in terms of leaf venation and perhaps also stomatal morphology and stomatal density. In leaf venation, *Cistanthe paniculata* more closely resembles *Cistanthe longiscapa* than *Cistanthe lamprosperma* (I.M. Johnston), *ined.* (Hershkovitz 1990b).

I have elsewhere (Hershkovitz 1990b) cited *Ferreyra 10486* as *Cistanthe* cf. *ruizii* (Macbride) *ined.*

Cistanthe picta (Gillies *ex* Arn. *in* Cheek) Carolin *ex* Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia picta* Gillies *ex* Arn. *in* Cheek, *Edinburch J. Nat. Geogr. Sci.* 3:355. 1831.

SPECIMENS EXAMINED: ARGENTINA. Mendoza: *Gerth 107* (L). San Juan: *Castellanos 15588* (US).

CHILE. Without locality: *Gay s.n.* (photograph of type of *Calandrinia oblongifolia* Barnéoud *in* Gay, US *ex* P). Without province: *Meyen s.n.* "Cord. St. Fernando" (B). Aconcagua: *Hutchinson 98* (UC, US); *Morrison 17304* (NA, UC); *West 5169* (UC); *Zollner 3642* (L); *Zollner 6548* (NA); *Zollner 11032* (NA). Antofagasta: *Werdermann 1038* (US, UC). Atacama: *Johnston 6218* (US). Coquimbo: *Worth & Morrison 16584* (NA, UC). Metropolitana: *Grandjot s.n.*, "XII. 32" (M); *Grandjot s.n.*, "XII. 34" (M); *Hastings 471* (UC); *Joseph 2956* (US); *Kuntze s.n.*, "I 92" (US); *Morrison 16786* (NA, UC); *Werdermann 648* (UC, CAS). O'Higgins: *Gay s.n.* (photograph, not type material *fide* Peralta [1988], US *ex* G-DEL); *Pennell 12279* (F).

Cistanthe picta and related members of Reiche's (1897, 1898) *Calandrinia* sect. *Andinae* are readily distinguishable from other *Cistanthe* by their: Thick, perennial roots; spreading habit; short stems bearing numerous, usually obovate to ovate, petiolate leaves; and congested cymules occurring immediately above the leafy stems and bearing relatively short pedicelled flowers and persistent, conspicuously black etched bracts. Also, the plants occur at higher elevation (mostly 2500 to 3500 m) than other species of *Cistanthe*. Despite the distinctiveness of this group, Reiche's (1898) key separates *Calandrinia* sect. *Andinae* from other members of *Cistanthe* sect. *Cistanthe* only with respect to leaf shape, although leaf shape is highly variable throughout the genus (Hershkovitz 1990b).

Cistanthe picta appears to represent a highly polymorphic entity from which notable variants have been segregated. Without seeing additional and type material, I cannot make any judgment regarding the distinctiveness of

most of the segregates recognized or listed in synonymy by Reiche (1898). Those recognized here are *C. picta* var. *frigida* (Barnéoud in Gay) Hershkovitz (see below) and *Cistanthe macrocalyx* (see above). I do note, however, that Johnston annotated his Atacama collection (*J. 6218*) as possibly representing a new species. It has conspicuous reniform bracts ca. 5 mm wide – roughly twice the norm.

A surprisingly large number of specimens of *Cistanthe picta* have been annotated, sometimes emphatically, mostly anonymously, as *Calandrinia arenaria* Cham. The type and subsequent descriptions and illustrations of *Calandrinia arenaria* Cham. (Chamisso 1831; Hooker & Arnott 1833; Lindley 1833) all clearly pertain to *Cistanthe arenaria* as delimited by Reiche (1898).

Cistanthe picta (Gillies ex Arn. in Cheek) Carolin ex Hershkovitz var. *frigida* (Barnéoud in Gay) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia frigida* Barnéoud in Gay, *Fl. Chil. [Hist. Física y Política de Chile, Botánica]* 2:495. 1847 (“1846”).

SPECIMENS EXAMINED: CHILE. Without province: Gay s.n., “1333 34” (P). Coquimbo: Gay s.n. (photograph of type of *Calandrinia frigida*, fide Peralta [1988], US ex P); Morrison 16992 (NA, UC).

Peralta (1988) listed this variety in synonymy with the species. This variety occurs at higher altitudes than the rest of the species, which may account for its reduced morphology. Kelley (1973), however, reported glabrous, colliculate seeds, like those of Morrison 16992, in *Cistanthe picta* var. *frigida*. The Gay collection has no seeds. Leaves of this specimen also lack sinuous and ribbonlike veins that occur in *Cistanthe picta* and nearly all other species of *Cistanthe* (Hershkovitz 1990b).

Cistanthe weberbaueri (Diels) Carolin ex Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia weberbaueri* Diels, *Bot. Jahrb. Syst.* 37:399. 1906.

SPECIMENS EXAMINED: PERÚ. Arequipa: Ferreyra 11723 (US); Ferreyra 12006 (US). Lima: Weberbauer 5321 (F).

As noted above, the distinction between *Cistanthe weberbaueri* and *C. lingulata* is tenuous. Weberbauer 5321 is unusual: It has the broadest leaves of any specimens I have examined in the *lingulata/weberbaueri* complex, and it has distinctly hairy seeds. The seed morphology of the other cited specimens accords with Kelley (1973), who reported pusticulate-tomentose seeds in *Cistanthe lingulata*, *Cistanthe weberbaueri*, and *Calandrinia quivensis*. Weberbauer 5321 was apparently miscited by Macbride (1937) as “5221.”

Specimens not determined: The specimens listed below belong to species of *Cistanthe* sect. *Cistanthe* listed above, species not yet transferred from *Calandrinia*, or possibly to new species. The specimens are all from Chile.

- Beetle 26145* (NA, UC), Region Atacama – Johnston annotated these sheets as *Cistanthe cymosa*, probably because of the congested inflorescence and yellow flowers. The habit, stems, leaves, and seeds are not as in *Cistanthe cymosa*, however. The plant looks more like a large, grotesque specimen of *Cistanthe arenaria*.
- Bertero 683* (P), Region O'Higgins – suggests *Cistanthe arenaria* or *Calandrinia solisii*, and possibly a mixture of both forms.
- Joseph 2785* (US), Region Metropolitana – lax, spreading habit of *Cistanthe arenaria* but seeds and pedicels of *Cistanthe grandiflora*.
- Philippi s.n.* (B), locality illegible – I have elsewhere (Hershkovitz 1990b) referred to this collection as *Cistanthe glaucopurpurea* (Reiche), *ined.* – it clearly is not that species, but I do not know what to call it.
- Rose & Rose 19318* (US), Region Coquimbo – suggests either *Cistanthe fenzlii* or *Cistanthe arenaria*, but the hairy seeds indicate a relationship to the *Cistanthe grandiflora* complex.
- Simon 454* (UC), Region Coquimbo – suggests *Cistanthe arenaria* but much larger.
- Worth & Morrison 16184* (NA, UC), Region Atacama – I have elsewhere (Hershkovitz 1990b) cited this specimen as *Cistanthe lamprosperma* (I.M. Johnston), *ined.* – it is not that species. It is very similar to *Cistanthe longiscapa* and was determined by Johnston as *Calandrinia litoralis*. The leaf epidermis, however, is prominently papillate – a feature Johnston (1929) emphasized in his description of *Calandrinia lamprosperma*. As Johnston (1929) noted, however, the latter species is otherwise most similar to members of the *Cistanthe grandiflora* complex.
- Worth & Morrison 16563* (G, NA, US), Region Coquimbo – Johnston annotated this specimen “nsp.?” In habit and leaves, it is identical to *Cistanthe picta*, but the few flowered inflorescence, long pedicels, and large flowers with unmarked sepals are unusual.
- Zollner 6385* (L, NA), Region Coquimbo – like *Rose & Rose 19318* (see above).
- Zollner 9807* (NA), Region Coquimbo – like *Philippi s.n.* (B – see above).
- Zollner 10636* (NA), Region Coquimbo – mixed collection including one plant similar to *Joseph 2785* (see above) and three plants suggesting *Cistanthe arenaria* but with hairy rather than merely pustulate seeds.

B. *Cistanthe* sect. *Amarantoides*

Cistanthe sect. *Amarantoides* (Reiche) Carolin ex Hershkovitz, *Phytologia* 68:269. 1990.

This section includes all members of *Calandrinia* sect. *Amarantoideae*. I had previously (Hershkovitz 1990a, 1990b) employed Reiche's (1897) spelling for this section, but the suffix "-oides" is correct.

Cistanthe calycina (Philippi) Carolin ex Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia calycina* Philippi, *Fl. Atacam.* 21. 1860, and *Viaje al Desierto de Atacama* 196. 1860.

SPECIMENS EXAMINED: CHILE. Antofagasta: *Johnston* 3590 (US); *Johnston* 5252 (US); *Johnston* 5253 (US); *Johnston* 5318 (US); *Lourteig* 2580 (US); *Werdermann* 868 (CAS, UC); *Werdermann* 1033 (CAS, UC); *Worth & Morrison* 15825 (NA, UC). Atacama: *Joseph* 4976 (US); *Werdermann* 418 (CAS, UC, US).

PERÚ. Arequipa: *Vargas* 7992 (US).

Cistanthe calycina is distinguished from other species of *Cistanthe* sect. *Amarantoides* by its diminutive habit and linear to linear lanceolate leaves. Macbride (1937) did not list this species for Perú. Cullen (1953) listed it for Argentina, but the specimen cited may belong to *Calandrinia minuscula* Cullen (D. Ford, pers. comm.). I have not seen adequate material of the latter species, so I have not provided a new combination here.

Cistanthe densiflora (Barnéoud in Gay) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia densiflora* Barnéoud in Gay, *Fl. Chil.* [*Hist. Física y Política de Chile, Botanica*] 2:502. 1847 ("1846").

SPECIMENS EXAMINED: ARGENTINA. San Juan: *Cabrera, et al.* 29553 (US); *Castellanos* 15520 (US).

CHILE. Antofagasta: *Martin* 540 (UC). Atacama: *Philippi* s.n. "1888" (B); *Zollner* 4282 (L); *Zollner* 5053 (L). Coquimbo: *Gay* s.n. (photograph of type, US ex P); *Gay* s.n. (photograph of type of *Calandrinia fasciculata* Philippi, *fide* Peralta [1988], US ex W).

Peralta (1988) listed two species in synonymy with *Cistanthe densiflora* that Reiche (1898) had recognized as distinct: *Calandrinia fasciculata* Philippi and *Calandrinia barneoudii* Philippi. Reiche (1898), however, mentioned *Cistanthe densiflora* as a problematic species pertaining to section *Amarantoides*. The inflorescence morphology in the type specimen of *Cistanthe densiflora* is intermediate between the more capitate cymes of *Calandrinia fasciculata*

and the more open inflorescence with several spikelike cymules of *Calandrinia spicata* Philippi (also recognized by Reiche, 1898). If *Calandrinia fasciculata* is conspecific with *Cistanthe densiflora*, then *Calandrinia spicata* probably is also. The extremes, however, are quite distinct.

Cistanthe salsoloides (Barnéoud in Gay) Carolin ex HersHKovitz. Phytologia 68:269. 1990.

SPECIMENS EXAMINED: ARGENTINA. San Juan: *Fabris & Marchionni 2279* (US).

CHILE. Without data: one sheet (US no. 1038131). Antofagasta: *Werdermann 1048* (leg. Francke; CAS, F, UC - two sheets, US - two sheets); *Werdermann 1015* (US). Atacama: *Biese 720* (CAS); *Greninger 19* (CAS); *Harding 22850* (US); *Zollner 10633* (NA). Coquimbo: *Gay 918* (photograph of type, US ex P). Tarapacá: *Brandege s.n.* (fragment, UC).

Two additional species of *Cistanthe* sect. *Amarantoides* listed by Reiche (1898), *Calandrinia acuminata* Philippi and *Calandrinia spicigera* Philippi, pertain to *Cistanthe salsoloides*. *Calandrinia acuminata* supposedly differs in having more elongate basal leaves, but these leaves possibly represent ephemeral basal leaves that also occur in *Cistanthe salsoloides*, as evident from one of the US sheets of the widely distributed *Werdermann 1048* collection. Based on Reiche's (1898) description, *Calandrinia spicigera* is to *Cistanthe salsoloides* what *Calandrinia spicata* is to *Cistanthe densiflora* - the inflorescences in *Calandrinia spicigera* and *Calandrinia spicata* are similar (see above). I have not seen any material that corresponds to the description of *Calandrinia spicigera*, however.

C. *Cistanthe* sect. *Philippiamra* (Kuntze) HersHKovitz

Cistanthe sect. *Philippiamra* (Kuntze) HersHKovitz, Phytologia 68:269. 1990.

Vegetatively, members of this section are extremely similar to *Cistanthe* (*Amarantoides*) *salsoloides*. I doubt that sterile material could be confidently identified as belonging to one or the other section. The geographic range of *Cistanthe* sect. *Philippiamra* is smaller than that of *Cistanthe* sect. *Amarantoides*, though, and the former apparently does not occur in Argentina.

Cistanthe amarantoides (Philippi) Carolin ex HersHKovitz, *comb. nov.*

BASIONYM: *Silvaea amarantoides* Philippi, *Fl. Atacam.* 22. 1860, and *Viage al Desierto de Atacama* 196. 1860.

SPECIMENS EXAMINED: CHILE. Antofagasta: *Philippi s.n.* (number illegible, possibly 34; poor photograph of type, det. C. Muñoz-P., UC ex SGO). Atacama: *Werdermann 477* (CAS).

Philippi (1860a, 1860b) and Reiche (1898) emphasized a distinction in growth form between *Cistanthe amarantoides* and *Cistanthe celosioides*, the former having simple and prostrate rather than ramified and erect branches, respectively. Johnston (1929), however, distinguished the species on the basis of bract morphology – pale, elliptic-oblong and relatively small in *Cistanthe amarantoides* vs. colored and broadly ovate in *Cistanthe celosioides*. This bract size and shape distinction is not emphasized in the type descriptions (cf. *Philippi* 1860a, 1860b). The only specimen I have seen that stands out as having the bract morphology described by Johnston (1929) is that listed above. I have elsewhere (Hershkovitz 1990b) listed *Werdermann 862* (see below) under *Cistanthe amarantoides* because of its branching habit, but Johnston (1929) cited this specimen as *Cistanthe celosioides*.

Cistanthe celosioides (*Philippi*) Carolin ex Hershkovitz, *Phytologia* 68:269. 1990.

SPECIMENS EXAMINED: CHILE. Antofagasta: *Biese 613* (UC); *Morrison 17092* (NA); *Philippi s.n.* (poor photograph of type, det. C. Muñoz-P., UC ex SGO); *Werdermann 862* (CAS, UC); *Werdermann 998* (CAS); *West 3859* (UC); *Worth & Morrison 15820* (UC). Atacama: *Beetle 26152* (NA); *Beetle 26183* (NA; UC); *Martcorena, et al. 40623* (F); *Philippi s.n.* (leg. *San Roman*; poor photograph of type of *Silvaea capitata* *Philippi*, det. C. Muñoz-P.; UC ex SGO); *Philippi s.n.* (leg. *F. Ph.*; poor photograph of type of *Silvaea fastigata* *Philippi*, det. C. Muñoz-P.; UC ex SGO); *Werdermann 165* (*Silvaea capitata* *Philippi fide* *Werdermann*; CAS, UC); *Werdermann 375* (CAS, UC). Tacna: *Werdermann 731* (CAS, UC). Tarapacá: *Zollner 7811* (NA); *Zollner 9603* (NA).

According to Johnston (1929), *Cistanthe celosioides*, *Silvaea pachyphylla* *Philippi* and *Silvaea fastigata* *Philippi*, which Reiche (1898) recognized as distinct, are phases of one variable species. I cannot confidently sort specimens into the three species, so I have referred them all to *Cistanthe celosioides*.

2. New combination and status for *Monocosmia*

Morphological evidence (Carolin 1987; Hershkovitz 1990b) indicates that the monotypic genus *Monocosmia* is closely related to *Calandrinia* sect. *Calandrinia* (syn. *C. sect. Compressae* Reiche), and that both are probably derived from a common ancestor in *Calandrinia* sect. *Acaules* Reiche. On cladistic

principles, therefore, *Monocosmia* should be included in *Calandrinia*. In recognizing *Monocosmia* as a distinct section of *Calandrinia*, I realize that *Calandrinia* sect. *Acaules* and/or *Calandrinia* might then be paraphyletic (cf. Hershkovitz 1990b). Additional investigation will be required to confirm this, however.

Calandrinia Kunth in H.B.K. sect. *Monocosmia* (Fenzl in Endl. & Fenzl) Hershkovitz, *comb. & stat. nov.* BASIONYM: *Monocosmia* Fenzl in Endl. & Fenzl, Nov. stirp. dec. 84. 1839. TYPE: *Talinum monandrum* Ruiz Lopez & Pavón (= *Calandrinia monandra* [Ruiz Lopez & Pavón] DC.).

3. New combination in *Talinum*

Talinum galapagosum (H. St. John) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia galapagosa* H. St. John, Amer. J. Bot. 24:95. 1937.

Kelley & Swanson (1986) established *Calandrinia* sect. *Pachypodae* to accommodate two species, *Calandrinia pachypoda* Diels (with two subspecies) and *Calandrinia galapagosa* H. St. John. The capsule, seed, and pollen traits (cf. Kelley & Swanson 1986) that distinguish *Calandrinia* sect. *Pachypodae* from other sections of *Calandrinia* sensu lato (cf. Kelley 1973; Hershkovitz 1990b) characterize species of the genus *Talinum*. *Calandrinia pachypoda* seems to represent high altitude and/or xeric forms of the pantropical weed *Talinum triangulare* (Jacq.) Willd. Whether these forms deserve taxonomic recognition is unclear but should depend on the overall degree and pattern of variation in the latter species. *Talinum galapagosum* has small linear leaves and is thus most likely related to vegetatively similar species that are fairly well diversified in North America, although at least one of these species occurs in Argentina. While the precise taxonomic relationship of *Talinum galapagosum* remains uncertain, its geographic isolation from similar congeners warrants its continued recognition as a distinct species.

ACKNOWLEDGMENTS

I thank Walter Kelley, (especially) Donna Ford, Alan Smith, and someone else for assistance in working up this manuscript.

LITERATURE CITED

- Carolín, R.C. 1987. A review of the family Portulacaceae. Austral. J. Bot. 35:383-412.
- . in press. Portulacaceae, in K. Kubitzki (ed.), Families and genera of flowering plants.
- Chamisso, A.L. von. 1831. De plantas in Expeditione Romanzoffiana observatis disserere pergitum. Linnaea 6:545-592.
- Cullen, D.A.S. de. 1953. Las especies Argentinas del género *Calandrinia* (Portulacaceae). Bol. Soc. Argent. Bot. 5:1-29.
- Hershkovitz, M.A. 1990a. Nomenclatural changes in Portulacaceae. Phytologia 68:267-270. 1990.
- . 1990b. Phylogenetic and morphological studies in Portulacaceae. Ph. D. dissertation, University of California, Davis.
- Hooker, W.J. & G.A.W. Arnott. 1833. Contributions towards a flora of South America and the islands of the Pacific [part 2]. Bot. Misc. 3:302-367.
- Johnston, I.M. 1928. Some undescribed American spermatophytes. Contr. Gray Herb. 85:1-164.
- . 1929. Papers on the flora of northern Chile. Contr. Gray Herb. 85:1-164.
- Kelley, W.A. 1973. Pollen morphology and relationships in the genus *Calandrinia* H.B.K. (Portulacaceae). M.S. thesis, California State Univ., Northridge.
- & J.R. Swanson. 1986. A new section and subspecies of *Calandrinia* (Portulacaceae). Phytologia 60:171-179.
- Lindley, J. 1833. *Calandrinia arenaria*. Bot. Reg. 19:1605.
- Macbride, J.F. 1931. Spermatophytes, mostly Peruvian-III. Publ. Field Mus. Nat. Hist., Bot. Ser. 11:1-35 [publication 288].
- . 1937. Portulacaceae. Pp. 562-573 in J.F. Macbride, Flora of Peru. Vol. 13, pt. 2 [Publ. Field Mus. Nat. Hist., Bot. Ser.], Field Museum of Natural History, Chicago.
- Peralta, I.E. 1988. Sinopsis de las especies de *Calandrinia* (Portulacaceae) de los Andes Mendozinos. Bol. Soc. Argent. Bot. 25:511-537.

- Philippi, R.A. 1860a. *Florula atacamensis*. Halis saxonum [Halle], Sumptibus Eduardi Anton.
- . 1860b. *Viage al Desierto de Atacama*. Halle en Sajonia, Libreria de Eduardo Anton. [includes reprinting of Philippi (1860a)].
- . 1894a. Plantas nuevas chilenas (continuación). *Anales Univ. Chile* 85:167-195.
- . 1894b. Plantas nuevas chilenas (continuación). *Anales Univ. Chile* 85:299-324.
- Reiche, K. 1897. Zur systematik der Chilenischen Arten der Gattung *Calandrinia*. *Ber. Deutsch. Bot. Ges.* 15:493-503.
- . 1898. *Flora de Chile*. Vol. 2. University of Chile, Santiago.